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The Relationship Between Body Mass Index and Sitting Duration with the Level of Low Back Pain Among Employees at Pamulang University, South Tangerang City

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Abstract

Low Back Pain (LBP) is one of the most common musculoskeletal disorders among working-age adults and continues to be a major cause of global disability, particularly among administrative employees who spend long hours sitting. This study aimed to analyze the relationship between Body Mass Index (BMI) and sitting duration with the incidence of LBP among employees at Pamulang University. A cross-sectional design was used with 227 respondents selected through purposive sampling, and LBP was measured using the Oswestry Disability Index (ODI). Data were analyzed using univariate, bivariate (Chi-square), and multivariate (multiple logistic regression) tests. The findings showed that the prevalence of severe LBP was 47.1%, with significant associations found between BMI (p<0.001) and sitting duration (p<0.001) and the occurrence of LBP. Multivariate analysis indicated that BMI ≥23 kg/m² (OR=3.301; 95% CI: 1.788–6.094) and sitting more than 6 hours per day (OR=6.064; 95% CI: 3.289–11.181) were the dominant risk factors, explaining 27.5% of the variance (Nagelkerke R²=0.275). In conclusion, BMI and prolonged sitting time are significant independent predictors of LBP, suggesting the need for improved workplace ergonomics and the promotion of healthy lifestyle habits to support optimal body weight.

Keywords: Body Mass Index, Sitting Duration, Low Back Pain, Ergonomics, University Employees

INTRODUCTION

Low Back Pain (LBP) is one of the most common health problems among the productive-age population. The World Health Organization (WHO) and the Global Burden of Disease (GBD) have ranked LBP as the leading cause of *years lived with disability (YLD)* worldwide since 2017, surpassing other musculoskeletal disorders. In 2021, approximately 453 million working-age adults suffered from LBP, an increase from 297 million cases in 1990. The global burden analysis reported that the total global prevalence of LBP in 2021 was around 628.84 million individuals, with an age-standardized annual prevalence rate of 7,463 per 100,000 population.

In Indonesia, the prevalence of LBP among workers ranges between 18–32%, depending on the type of occupation. Studies have found that the prevalence of LBP among office administrative workers is 32.2%, while among students it reaches 61.2%. These relatively high figures are concerning, as LBP commonly occurs in young to middle-aged adults—the most productive age group. The 2023 Basic Health Research (Riskesdas) report noted that the prevalence of obesity among adults reached 23.4%, up from 21.8% in 2018. When combined with sedentary behaviors such as prolonged sitting, the potential risk of developing LBP is expected to increase significantly.

One of the main factors strongly associated with LBP is the Body Mass Index (BMI). Individuals with a high BMI (classified as overweight or obese) tend to experience increased pressure on the lumbar spine, postural biomechanical changes, and systemic inflammation due to excessive adipose tissue. A meta-analysis revealed that obesity increases the risk of LBP by 1.35 times compared to individuals with normal BMI. Besides internal factors, external factors such as prolonged sitting also play a significant role in the occurrence of LBP, particularly among

office workers. Studies indicate that individuals who sit for more than 7 hours per day have a 1.33 times higher risk of experiencing LBP compared to those who sit for less than 4 hours. Another meta-analysis showed that prolonged sitting increases the risk of LBP (OR 1.42), and the risk is even higher among vehicle drivers (OR 2.03).

Previous studies have mostly focused on the relationship between a single factor and LBP, such as only assessing sitting duration or only evaluating BMI. There is still a lack of research that simultaneously examines the role of both factors among office workers or university employees in Indonesia. This forms the research gap, namely the absence of local studies exploring the combined effect of BMI and sitting duration on LBP, particularly among university employees. Therefore, this study aims to analyze the relationship between Body Mass Index (BMI) and sitting duration with the occurrence of Low Back Pain (LBP) after controlling for age, gender, and years of service among employees at Pamulang University, South Tangerang City.

RESEARCH METHODS

This study employed an observational design with a cross-sectional method. The research was conducted at Pamulang University, South Tangerang. The population consisted of all administrative employees at Pamulang University. The sampling technique used was purposive sampling, with a total of 227 respondents.

The inclusion criteria were: permanent employees with at least one year of service, aged 20–50 years, willing to participate in the study, and able to communicate effectively. The exclusion criteria were: individuals with a history of spinal trauma, those who were pregnant, or those with congenital spinal abnormalities.

Primary data were obtained directly from respondents through a self-administered questionnaire and anthropometric measurements (body weight and height). The Low Back Pain variable was measured using the Oswestry Disability Index (ODI), consisting of 10 items scored from 0–5. The total score was converted into a percentage and categorized as:

- Severe LBP: ODI > 40%
- Mild–Moderate LBP: ODI ≤ 40%

BMI was calculated using the formula:

$$\text{BMI} = \frac{\text{Weight (kg)}}{\text{Height (m)}^2}$$

and categorized as:

- Overweight–Obese: BMI ≥ 23 kg/m²
- Normal: BMI < 23 kg/m²

Sitting duration was measured using a self-reported questionnaire and categorized as:

- >6 hours/day
- ≤6 hours/day

Data analysis consisted of univariate analysis to describe the frequency distribution of each variable, bivariate analysis using the Chi-square test to determine the association between independent and dependent variables, and multivariate analysis using multiple logistic regression to identify the most significant factors. This study received ethical approval under letter number 075/S.Ket/KEPK/UMHT/VII/2025.

RESULTS AND DISCUSSION

Respondent Characteristics

The results of the univariate analysis showed that out of 227 respondents, the majority were in the early adulthood group (≤35 years), accounting for 162 individuals (71.4%). Most respondents were female (54.2%), had a long working period (≥5 years) of 57.7%, and were classified as having an overweight–obese BMI (≥23 kg/m²) at 57.7%. Additionally, most respondents reported sitting for ≤6 hours per day (59%), while 41% sat for more than 6 hours per day. The prevalence of severe LBP was 47.1%, whereas 52.9% experienced mild to moderate LBP.

Table 1. Frequency Distribution Based on Respondent Characteristics (n = 227)

Variable	Category	Frequency (n)	Percentage (%)
Age	Late adulthood (>35 years)	65	28,6
	Early adulthood (≤35 years)	162	71,4
	Total	227	100,0
Gender	Female	123	54,2
	Male	104	45,8
	Total	227	100,0
Years of service	Old (≥5 tahun)	131	57,7
	New (<5 tahun)	96	42,3
	Total	227	100,0
Body Mass Index	Overweight-Obesitas (≥23)	131	57,7
	Normal (<23)	96	42,3
	Total	227	100,0
Sitting Time	>6 hours/day	93	41,0
	≤6 hours/day	134	59,0
	Total	227	100,0
Low Back Pain	Heavy (ODI >40%)	107	47,1
	Light-Moderate (ODI ≤40%)	120	52,9
	Total	227	100,0

Bivariate Analysis

Bivariate analysis showed that age was not significantly associated with LBP (p=0.487; OR=1.23). Gender also showed no significant association with LBP (p=0.785; OR=1.08). Length of service was not significantly associated with LBP (p=0.313; OR=1.31). However, there was a significant association between BMI and the incidence of LBP (p<0.001). Employees with an overweight-obese BMI (≥23 kg/m²) had 76 (58.0%) more people experiencing severe LBP compared to the normal BMI group (32.3%), with an OR=2.90 (95% CI: 1.67–5.03).

Sitting time also showed a significant association with the incidence of LBP (p<0.001). Employees who sat for >6 hours/day had 66 (71.0%) who experienced severe LBP, while those who sat for ≤6 hours/day had only 41 (30.6%), with an OR of 5.55 (95% CI: 3.11–9.90).

Table 2. Relationship of Independent Variables with Low Back Pain Incidence

Variable	Category	LBP Heavy n (%)	LBP Light-Moderate n (%)	Total	p-value	OR (95% CI)
Age	Late adulthood (>35)	33 (50,8)	32 (49,2)	65	0,487	1,23 (0,69-2,18)
	Early adulthood (≤35)	74 (45,7)	88 (54,3)	162		
Gender	Female	59 (48,0)	64 (52,0)	123	0,785	1,08 (0,64-1,82)
	Male	48 (46,2)	56 (53,8)	104		
Years of service	New (<5)	49 (51,0)	47 (49,0)	96	0,313	1,31 (0,77-2,23)
	Old (≥5)	58 (44,3)	73 (55,7)	131		
IMT	Overweight-Obesitas (≥23)	76 (58,0)	55 (42,0)	131	<0,001	2,90 (1,67-5,03)
	Normal (<23)	31 (32,3)	65 (67,7)	96		
Sitting Time	>6 hours/day	66 (71,0)	27 (29,0)	93	<0,001	5,55 (3,11-9,90)

Multivariate Analysis

Multiple logistic regression analysis showed that after controlling for confounding variables (age, gender, and length of service), only BMI and sitting duration remained significantly associated with LBP. The final model results showed:

• BMI ≥23 kg/m² had an OR=3.301 (95% CI: 1.788–6.094; p<0.001)
• Sitting duration >6 hours/day had an OR=6.064 (95% CI: 3.289–11.181; p<0.001)

Table 3. Results of Multivariate Logistic Regression Analysis (Final Model)

Variable	p-value	OR	95% CI
IMT (≥23 kg/m²)	<0,001	3,301	1,788–6,094
Sitting Time (>6 jam/hari)	<0,001	6,064	3,289–11,181

Table 4. Model Feasibility and Accuracy Test

Statistics	Value
Test Hosmer and Lemeshow (p-value)	0,363
Nagelkerke R²	0,275
Overall Classification Accuracy	70,0%
- Severe LBP	61,7%
· Mild-Moderate LBP	77,5%

The Hosmer and Lemeshow test showed a p-value of 0.363 (model fit). The Nagelkerke R² value of 0.275 indicated that the combination of BMI and sitting duration explained 27.5% of the variation in the incidence of severe LBP, with an overall classification accuracy of 70.0%.

Discussion

This study revealed that the prevalence of LBP among employees at Pamulang University was relatively high (47.1%), consistent with previous studies reporting high rates of LBP among office and administrative workers. The multivariate analysis confirmed that sitting duration was the most dominant risk factor (OR = 6.064), followed by BMI (OR = 3.301). These findings align with biomechanical theory, which suggests that static sitting increases intradiscal pressure by up to 40% compared to standing, and that excess body weight further exacerbates the mechanical load on vertebral structures.

The absence of a significant relationship between age, gender, and years of service with LBP indicates that within this population, ergonomic and individual physical factors (BMI and sitting duration) exert a stronger influence than demographic characteristics. This may suggest that similar occupational exposures among employees contribute to an equalization of risk levels. The Nagelkerke R^2 value of 0.275 highlights the multifactorial nature of LBP, where the remaining 72.5% of variance may be explained by other factors such as psychosocial stressors, physical activity levels, and specific ergonomic conditions not measured in this study.

This research reinforces existing evidence that both mechanical mechanisms and physiological conditions (e.g., obesity-related inflammation) play roles in the relationship between BMI and LBP. The clinical and practical implications of these findings emphasize the need for a comprehensive workplace intervention program that integrates weight management and behavioral modification related to sitting habits.

CONCLUSION AND RECOMMENDATIONS

This study concludes that BMI $\geq$ 23 kg/m² and sitting duration > 6 hours/day are significant independent risk factors for severe LBP among employees at Pamulang University, with prolonged sitting identified as the most dominant contributor to increased LBP risk.

Recommendations:

1. For the institution: Pamulang University should strengthen its occupational ergonomics program by providing ergonomic workplace facilities, conducting regular health assessments, and promoting awareness about maintaining an ideal body weight.
2. For employees: Maintain a healthy body weight, minimize prolonged sitting, incorporate stretching or active breaks periodically, and pay attention to proper posture while working.
3. For future researchers: Conduct longitudinal studies and include additional variables such as psychosocial factors, physical activity levels, and specific ergonomic risk factors to obtain a more comprehensive understanding of LBP determinants.

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